

Subcl
17. (Amended) The method according to claim 11, further comprising the step of creating a step topology within said recording head before the step of depositing the magnetically permeable material.

18. (Amended) The method according to claim 17, wherein said step of creating a step topology is performed by photolithography of the nonmagnetic substrate in advance of depositing said magnetically permeable coating.

19. (Amended) The method according to claim 17, further comprising the step of securing said nonmagnetic substrate to a joint before said step of creating a step topology within said recording head.

20. (Amended) The method according to claim 19, wherein said step of securing said nonmagnetic substrate to a joint is performed by vacuum deposition.

Please add Claims 21-23 as follows:

21. (New) The perpendicular recording head of Claim 1, wherein the width of the main pole is less than 300 nm.

22. (New) The perpendicular recording head of Claim 1, wherein the thickness of the main pole is from 100 to 1,000 nm.

23. (New) The perpendicular recording head of Claim 11, wherein the magnetically permeable material is deposited at a thickness of less than 300 nm.

REMARKS

Upon entry of this Amendment, Claims 1-23 will be pending in the application.

Information Disclosure Statement

The Examiner's indication that Applicants' previously-filed Information Disclosure Statements have been considered is acknowledged. Applicants note that Application No. 09/726,157 filed November 29, 2000 and assigned to the Assignee of the present application, which was cited in Applicants' June 6, 2002 Information Disclosure Statement, has now issued as U.S. Patent No. 6,560,069. A copy of the issued patent is enclosed for consideration.

35 U.S.C. § 112 Rejections

Claims 4 and 18-20 stand rejected under 35 U.S.C. § 112, second paragraph, as allegedly being indefinite because the phrase “said nonmagnetic support” lacks antecedent basis. By the present Amendment, Claims 4 and 18-20 have been amended to change “nonmagnetic support” to “nonmagnetic substrate”. This change has been made in order to provide consistent terminology for the “nonmagnetic substrate” throughout the claims. No issue of new matter is presented.

35 U.S.C. §§ 102 and 103 Rejections

Claims 1-6, 9-11 and 13-16 stand rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Schewe U.S. 4,742,413. Claims 7, 12 and 17-20 stand rejected under 35 U.S.C. § 103(a) as allegedly being unpatentable over Schewe ‘413.

According to the Office Action, with respect to independent Claim 1, Schewe ‘413 discloses a perpendicular recording head including a main pole (10) and a magnetically permeable layer (9) for concentrating magnetic flux from the main pole (10) onto a small surface area of a magnetic recording medium (A).

With respect to independent Claim 2, the Office Action states that Schewe ‘413 discloses a perpendicular recording head including a nonmagnetic substrate (3) having a surface and a main pole (10) including a magnetically permeable plating (9) covering the substrate’s surface.

With respect to independent Claim 11, the Office Action states that Schewe ‘413 discloses a method of making a main pole (10) of a perpendicular recording head for use with a magnetic recording medium (A). According to the Office Action, the method includes the steps of providing a nonmagnetic substrate (3) having a surface and covering the substrate’s surface (3) with a magnetically permeable material (9).

It is submitted that amended independent Claims 1, 2 and 11 are patentable over Schewe ‘413.

Amended Claim 1 recites a perpendicular recording head comprising: a main pole having a width defined in a direction perpendicular to tracks of a magnetic recording medium and a thickness defined in a direction parallel with the tracks of the magnetic

recording medium; and means for concentrating magnetic flux from said main pole onto a small surface area of the magnetic recording medium, wherein the width of the main pole is less than the thickness of the main pole. Basis for the amended language of Claim 1 is provided in the specification, for example, at page 8, lines 17-20, page 9, lines 11-13, and Figs. 2 and 3. No issue of new matter is presented.

Schewe '413 does not teach or suggest the main pole configuration and function recited in Claim 1. Schewe '413 discloses a pole (10) made of a magnetic layer (10a) having a layer thickness (d_2) (see Fig. 1). Schewe '413 does not teach that the width of the pole (10) is less than its thickness (d_2). Applicants submit that the pole (10) would have a width that is larger than the thickness (d_2) of the pole (10) because Schewe '413 describes the pole (10) as being made of a "layer" of magnetic material (10a). One skilled in the art reading that the pole (10) of Schewe '413 is made of a layer of magnetic material (10a) would understand that the layer would have a thickness (d_2) less than the width of the layer. In further support of this position, attention is drawn to Schewe U.S. Patent No. 4,951,166 cited in Applicants' Information Disclosure Statement, which illustrates a similar magnetic head disclosed by the same inventor in which the pole (10) has a width (b_2) which is much greater than the thickness of the layer (10a) (see Fig. 2 of the Schewe 4,951,166 patent). Since Schewe '413 does not teach or suggest that the width of the pole (10) is less than the thickness (d_2) of the pole, it is submitted that Claim 1 is patentable thereover.

Amended Claim 2 recites a perpendicular recording head comprising: a nonmagnetic substrate having a surface oriented in a plane substantially parallel with tracks of a magnetic recording medium; and a main pole comprising a magnetically permeable material plated on the surface of the substrate. Basis for the amended language of Claim 2 is provided in the specification, for example, at page 9, lines 11-13, page 10 lines 9-20, and Figs. 2, 3 and 7-10. No issue of new matter is presented.

Schewe '413 does not teach or suggest the substrate and main pole arrangement recited in Claim 2. As shown in Fig. 1 and discussed at column 5, lines 12-18 of Schewe '413, the pole (10) is formed by a magnetic layer (10a) with a thickness (d_2) measured in a direction (v) corresponding to the relative direction of movement between the magnetic head and the recording medium. Thus, the pole (10) of Schewe '413 is oriented with its plating thickness parallel with the direction of relative movement (v) between the

head and the recording medium. Furthermore, the substrate (3) of Schewe '413 does not have a surface oriented in a plane substantially parallel with magnetic recording tracks upon which is plated a magnetically permeable main pole material. Accordingly, Schewe '413 does not teach or suggest the recording head recited in Claim 2.

Amended Claim 11 recites a method of making a main pole of a perpendicular recording head for use with a magnetic recording medium, said method comprising the steps of: providing a nonmagnetic substrate having a surface oriented in a plane substantially parallel with tracks of a magnetic recording medium; and depositing a magnetically permeable material on the surface of the substrate. Basis for the amended language of Claim 11 is provided in the specification, for example, at page 9, lines 11-13, page 10, lines 9-20, and Figs. 2, 3 and 7-10. No issue of new matter is presented.

Schewe '413 does not teach or suggest the substrate and main pole arrangement recited in Claim 11. As discussed above in connection with Claim 2, the pole (10) of Schewe '413 is oriented with its plating thickness parallel with the direction of relative movement (v) between the head and the recording medium. The substrate (3) of Schewe '413 does not have a surface oriented in a plane substantially parallel with magnetic recording tracks upon which is plated a magnetically permeable main pole material. Therefore, Schewe '413 does not teach or suggest the recording head recited in Claim 11.

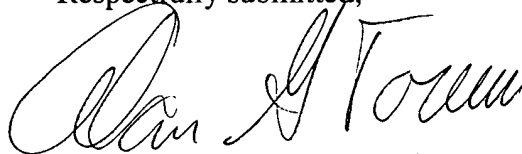
The dependent claims recite additional features which further serve to distinguish over Schewe '413. For example, dependent Claim 9 recites that the width of the main pole does not exceed 300 nm. Newly added Claim 21, which depends from Claim 1, similarly recites that the width of the main pole is less than 300 nm. Newly added Claim 23, which depends from Claim 11, recites that the magnetically permeable material is deposited at a thickness of less than 300 nm. As disclosed at column 5, lines 43-48, the thickness (d_2) of the magnetic layer (10a) of Schewe '413 is smaller than 2 microns, in particular smaller than 1 micron, and preferably smaller than 0.7 micron. The reference further states that the thickness (d_2) may be smaller than 0.4 micron (see column 5, line 54). Although Schewe '413 discloses that the thickness (d_2) of the pole (10) may be smaller than 0.4 micron, the reference does not explicitly teach a pole having a thickness of less than 300 nm. Accordingly, Claims 9, 21 and 23 further distinguish over Schewe '413.

Newly added Claim 22, which depends from Claim 1, recites that the thickness of the main pole is from 100 to 1,000 nm. Basis for the main pole thickness recited in Claim 22 is provided in the specification, for example, at page 10, lines 27 and 28. Schewe '413 is silent as to the width of the pole 10, and does not teach or suggest a size of from 100 to 1,000 nm, as recited in Claim 22.

In view of the foregoing amendments and remarks, it is submitted that Claims 1-23 are patentable over the prior art of record. Accordingly, an early notice of allowance of this application is respectfully requested.

In the event that any outstanding matters remain in connection with this application, the Examiner is invited to telephone the undersigned at (412) 263-4340 to discuss such matters.

Respectfully submitted,

A handwritten signature in cursive script, appearing to read "Alan G. Towner".

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Marked-up Version of Claims

1. (Amended) A perpendicular recording head[,] comprising:
a main pole having a width defined in a direction perpendicular to tracks of a magnetic recording medium and a thickness defined in a direction parallel with the tracks of the magnetic recording medium; and
means for concentrating magnetic flux from said main pole onto a small surface area of [a] the magnetic recording medium, wherein the width of the main pole is less than the thickness of the main pole.
2. (Amended) A perpendicular recording head[,] comprising:
a nonmagnetic substrate having a surface oriented in a plane substantially parallel with tracks of a magnetic recording medium; and
a main pole comprising a magnetically permeable [plating covering said substrate's surface] material plated on the surface of the substrate.
3. (Amended) The perpendicular recording head according to claim 2, wherein said magnetically permeable material is [an] electroplated [surface covering].
4. (Amended) The perpendicular recording head according to claim 2, wherein said nonmagnetic [support] substrate defines a step topology within said recording head.
9. (Amended) The perpendicular recording head according to claim 2, wherein said main pole has a width defined in a direction perpendicular to tracks of a magnetic recording medium, and said width does not exceed 300 nm.
11. (Amended) A method of making a main pole of a perpendicular recording head for use with a magnetic recording medium, said method comprising the steps of:

providing a nonmagnetic substrate having a surface oriented in a plane substantially parallel with tracks of a magnetic recording medium; and

[covering said substrate's surface with] depositing a magnetically permeable material on the surface of the substrate.
12. (Amended) The method according to claim 11, wherein said step of [covering said substrate's surface with a] depositing the magnetically permeable material is performed by plating.

13. (Amended) The method according to claim 11, wherein said magnetically permeable material [covering said substrate's surface] is magnetically soft.

14. (Amended) The method according to claim 13, wherein said magnetically permeable material [covering said substrate's surface] is permalloy.

15. (Amended) The method according to claim 13, wherein said magnetically permeable material [covering said substrate's surface] is Ni/Fe.

16. (Amended) The method according to claim 13, wherein said magnetically permeable material [covering said substrate's surface] is a nitride.

17. (Amended) The method according to claim 11, further comprising the step of creating a step topology within said recording head before the step of [covering said substrate's surface] depositing the magnetically permeable material.

18. (Amended) The method according to claim 17, wherein said step of creating a step topology is performed by photolithography of the nonmagnetic [support] substrate in advance of depositing said magnetically permeable coating.

19. (Amended) The method according to claim 17, further comprising the step of securing said nonmagnetic [support] substrate to a joint before said step of creating a step topology within said recording head.

20. (Amended) The method according to claim 19, wherein said step of securing said nonmagnetic [support] substrate to a joint is performed by vacuum deposition.

New Claims 21-23

21. (New) The perpendicular recording head of Claim 1, wherein the width of the main pole is less than 300 nm.

22. (New) The perpendicular recording head of Claim 1, wherein the thickness of the main pole is from 100 to 1,000 nm.

23. (New) The perpendicular recording head of Claim 11, wherein the magnetically permeable material is deposited at a thickness of less than 300 nm.